CLAIMS

What is claimed is:

1. A hybrid electric-laser propulsion (HELP) thruster, comprising:
a propellant having self-regenerative surface morphology;
a laser for ablating the propellant to create an ionized exhaust plasma that is non-interfering with a trajectory path of expelled ions; and
an electromagnetic field generator for generating an electromagnetic field that defines a thrust vector for the exhaust plasma.

2. The thruster of claim 1, further comprising a controller for implementing control algorithms for controlling the HELP thruster to meet commanded performance.

3. The thruster of claim 1, further comprising a baffle for protecting the laser from contaminants released when the propellant is ablated.

4. The thruster of claim 1, further comprising capillary subsystem for replenishing the propellant.

5. The thruster of claim 4, wherein the propellant is semi-molten during operation of the thruster and wherein the capillary subsystem utilizes surface tension of the semi-molten propellant.

6. The thruster of claim 4, further comprising a propellant gauge sensor for determining an amount of remaining propellant.

7. The thruster of claim 6, wherein voltage applied to capillary ducts of the capillary subsystem generates an electric field, the propellant having a dielectric constant sufficient to sustain the electric field, wherein the propellant gauge sensor measures capacitance of the capillary ducts to determine the amount.

8. The thruster of claim 1, further comprising a propellant housing for protecting the propellant from environmental factors.

9. The thruster of claim 1, further comprising one or more propellant heaters for heating the propellant such that it is in a molten state that enables inflow into capillary feed slots, to feed and replenishment the propellant at a point of ablation

10. The thruster of claim 1, further comprising one or more propellant heaters for heating a surface of the propellant such that the surface is in a semi-molten state, wherein propellant surface tension continually reforms the surface.

11. The thruster of claim 10, further comprising one or more propellant temperature sensors for monitoring temperature of the propellant to ensure that the propellant is not overheated but is maintained in a molten state in the propellant container.

12. The thruster of claim 1, further comprising one or more propellant temperature sensors for monitoring temperature of the propellant, the thruster utilizing the temperature sensors to maintain the propellant in a semi-molten state at a surface of the propellant.

13. The thruster of claim 1, the propellant comprising a wax-based material.

14. The thruster of claim 13, the propellant comprising Paraffin.

15. A multi-hybrid electric-laser propulsion (HELP) thruster, comprising:
a plurality of modular HELP thrusters ganged together to provide cooperative thrust, each of the HELP thrusters having:
a propellant with self-regenerative surface morphology;
a laser for ablating the propellant to create ionized exhaust plasma that is non-interfering with a trajectory path of expelled ions; and
an electromagnetic field generator for generating an electromagnetic field that defines a thrust vector for the exhaust plasma.

16. The multi-HELP thruster of claim 15, further comprising a controller for implementing control algorithms for controlling one or more of the HELP thrusters to meet commanded performance.

17. The multi-HELP thruster of claim 15, each unit further comprising capillary feed means for replenishing the propellant.

18. The multi-HELP thruster of claim 15, each of the HELP thrusters being modular in construction such that any one HELP thruster is replaceable with the multi-HELP thruster.

19. The multi-HELP thruster of claim 15, further comprising interlocking fixtures to connect the HELP thrusters together.

20. The multi-HELP thruster of claim 15, further comprising fiber optic pigtails and electrical bus for 'plug-and-play' supply of optical and power signals for the multi-HELP thruster.

21. The multi-HELP thruster of claim 15, the propellant comprising a wax-based material.

22. The multi-HELP thruster of claim 21, the propellant comprising Paraffin.

23. A method of providing thrust propulsion to a spacecraft, comprising:
pulsing laser energy onto a propellant having a self-regenerative surface morphology to ablate the surface and form ionized plasma; and
generating an electromagnetic field to collimate trajectory of the exhaust plasma to provide thrust.

24. The method of claim 23, the propellant comprising a wax-based material.

25. The method of claim 24, the propellant comprising Paraffin.

26. The method of claim 24, further comprising dynamically controlling the thrust during operation of the spacecraft.

27. The method of claim 26, the step of controlling comprising setting an operating regime to one of LSCW, LSCD, superdetonation or ablation dominated.

28. The method of claim 24, further comprising selecting thruster operation, thruster components and configuration, and propellant as a function of spacecraft mission.

29. A method of providing thrust propulsion to a spacecraft, comprising:

pulsing a plurality of lasers onto a plurality of propellants, each propellant having a self-regenerative surface morphology to ablate the surface and form ionized exhaust plasma; and

generating a plurality of electromagnetic fields to collimate trajectory of the exhaust plasmas to provide thrust.